

WHAT IS CLAIMED IS:

1 1. A method of utilizing discrete devices in a wellbore wherein a working fluid
2 provides fluid flow path for moving said discrete devices from a first location of
3 introduction of said devices into the flow path to a second location of interest, said
4 method comprising:

- 5 - selecting at least one flowable discrete device constituting a data
6 carrier that is adapted to be moved in the wellbore at least in part by
7 the working fluid ("flowable device");
- 8 - introducing the at least one flowable discrete device into the fluid flow
9 path at the first location to cause the working fluid to move the at least
10 one flowable device to the second location of interest; and
- 11 - providing a data exchange device in the fluid flow path for effecting
12 data exchange with the at least one flowable discrete device.

1 2. The method of claim 1, wherein selecting the at least one flowable device
2 comprises selecting the at least one flowable device from a group consisting of: (i)
3 a device having a sensor for providing a measure of a parameter of interest; (ii) a
4 device having a memory for storing data therein; (iii) a device carrying energy that
5 is transmittable to another device; (iv) a solid mass carrying a chemical that alters
6 a state when said solid mass encounters a particular property in the wellbore; (v) a

7 device carrying a biological mass; (vi) a data recording device; (vii) a device that is
8 adapted to take a mechanical action, and (viii) a self-charging device due to
9 interaction with the working fluid in the wellbore.

1 3. The method of claim 1, wherein said selecting the at least one flowable
2 device comprises selecting a device that provides a measure of a parameter of
3 interest selected from a group consisting of: (i) pressure; (ii) temperature; (iii) flow
4 rate; (iv) vibration; (v) presence of a particular chemical in the wellbore; (vi)
5 viscosity; (vii) water saturation; (viii) composition of a material; (ix) corrosion; (x)
6 velocity; (xi) a physical dimension; and (xi) deposition of a particular matter in a fluid.

1 4. The method of claim 1, wherein selecting at least one flowable device
2 comprises selecting a device that comprises:

- 3 - a sensor for providing a measurement representative of a parameter
4 of interest;
- 5 - a memory for storing data relating at least in part to the parameter of
6 interest;
- 7 - a source of power for supplying power to a component of said
8 flowable device; and
- 9 - a controller for determining data to be carried by said memory.

1 5. The method according to claim 4 further comprising providing a transmitter
2 for the at least one flowable device for effecting data exchange with the flowable
3 device.

1 6. The method of claim 5, wherein effecting the data exchange comprises
2 communicating with said at least one flowable device by a method selected from a
3 group consisting of: (i) electromagnetic radiation; (ii) optical signals; and (iii) acoustic
4 signals.

1 7. The method of claim 1, wherein selecting the at least one flowable device
2 comprises selecting a flowable device that is adapted to carry data that is one of (i)
3 prerecorded on the at least one flowable device; (ii) recorded on the at least one
4 flowable device downhole; (iii) self recorded by the at least one flowable device; (iv)
5 inferred by a change of a state associated with the at least one flowable device.

1 8. The method of claim 1, wherein selecting the at least one flowable comprises
2 selecting a device from a group of devices consisting of: (i) a device that is freely
3 movable by the working fluid; (ii) a device that has variable buoyancy; (iii) a device
4 that includes a propulsion mechanism that aids the at least one flowable device to

5 flow within the working fluid; (iv) a device that is movable within by a superimposed
6 field; and (v) a device whose movement in the working fluid is aided by the
7 gravitational field.

1 9. The method of claim 1, wherein selecting the at least one flowable device
2 comprises selecting a device that is one of: (i) resistant to wellbore temperatures;
3 (ii) resistant to chemicals; (iii) resistant to pressures in wellbores; (iv) vibration
4 resistant; (v) impact resistant; (vi) resistant to electromagnetic radiation; (vii)
5 resistant to electrical noise; and (viii) resistant to nuclear fields.

1 10. The method of claim 1, wherein said introducing the at least one flowable
2 device into the working fluid further comprises delivering the at least one flowable
3 device to the working fluid by one of (i) an isolated flow path; (ii) a chemical injection
4 line; (iii) a tubing in a wellbore; (iv) a hydraulic line reaching the second location of
5 interest and returning to the surface; (v) through a drill string carrying drilling fluid;
6 (vi) through an annulus between a drill string and the wellbore; (vii) through a tubing
7 disposed outside a drill string; and (viii) in a container that is adapted to release said
8 at least one flowable device in the wellbore.

1 11. The method of claim 1 further comprising recovering said at least one
2 flowable device.

1 12. The method of claim 14, wherein recovering the at least one flowable device
2 comprises recovering the at least one flowable device by one of (i) fluid to solid
3 separation; and (ii) fluid to fluid separation.

1 13. The method of claim 1, wherein said introducing the at least one flowable
2 device includes introducing a plurality of flowable devices each such flowable device
3 adapted to perform at least one task.

1 14. The method of claim 13, wherein said introducing a plurality of flowable
2 devices comprises one of (i) timed release; (ii) time independent release; (iii) on
3 demand release; and (iv) event initiated release.

1 15. The method of claim 1, wherein introducing said at least one flowable device
2 comprises delivering a plurality of flowable devices into fluid circulating in a wellbore
3 to cause at least a number of the flowable devices to remain in the wellbore at any
4 given time, thereby forming a network of the flowable devices in the wellbore.

1 16. The method of claim 15, wherein the flowable devices in said plurality of
2 devices are adapted to communicate information with other devices, thereby
3 forming communication network in the wellbore.

1 17. The method of claim 1 further comprising providing a unique address to the
2 at least one flowable device.

1 18. The method of claim 1 further comprising providing a data communication
2 device in the wellbore for communicating with the at least one flowable device.

1 19. The method of claim 18 further comprising causing the data communication
2 to exchange data with the at least one flowable device and to transmit a signal
3 confirming said data exchange.

1 20. The method of claim 1, wherein said selecting said at least one flowable
2 device comprises selecting the at least one flowable device that includes a sensor
3 that is one of (i) mechanical (ii) electrical; (iii) chemical; (iv) nuclear; and (v)
4 biological.

1 21. The method of claim 1 further comprising implanting a plurality of spaced
2 apart flowable devices in said wellbore during drilling of said wellbore.

1 22. The method of claim 7 further comprising receiving the data carried by said
2 at least one flowable device by a downhole device and transmitting a signal in
3 response to said received signal to a device located outside said wellbore.

1 23. The method according to claim 22 further comprising said device outside said
2 wellbore at a location that is one of: (i) in a lateral wellbore associated with said
3 wellbore; (ii) a separate wellbore; (iii) at the surface; and (iv) in an injection well.

1 24. A wellbore system utilizing at least one flowable device constituting a data
2 carrier that is adapted to be moved by a fluid flowing in the wellbore comprising:

3 (a) a forward fluid flow path associated with the wellbore for moving the
4 at least one flowable device from a first location of introduction of the
5 at least one flowable device into the forward fluid path to a second
6 location of interest;

7 (b) a data exchange device at the second location of interest for effecting
8 data exchange with the at least one flowable device that is one of (i)
9 retrieving information carried by the at least one flowable device; or
10 (ii) inducing selected information on the at least one flowable device.

1 25. The wellbore system of claim 24 further comprising a return fluid flow path
2 for moving the at least one flowable device from the second location of interest to
3 a return destination.

1 26. The wellbore system of claim 24, wherein the first location of introduction and
2 the return destination are at the surface.

1 27. The wellbore system of claim 25, wherein the forward flow path is through a
2 drill string utilized for drilling the wellbore and the return fluid flow path is an annulus
3 between the drill string and the wellbore.

1 28. The wellbore system of claim 25, wherein (i) the forward fluid flow path
2 comprises a first section of a u-tube extending from the first location to the second
3 location of interest and (ii) the return path comprises a second section of the u-tube
4 returning to the return destination.

1 29. The wellbore system of claim 24, wherein the second location of interest is
2 in the wellbore and the data exchange device is located proximate said second
3 location of interest.

1 30. The wellbore system of claim 24 further comprising a controller for
2 performing an operation that is one of (i) retrieving information from the at least one
3 flowable device from the data exchange device, or (ii) causing the data exchange
4 devices to induce a particular information onto the at least one flowable device.

1 31. The wellbore system of claim 25 further comprising a control unit for
2 processing data contained in the flowable device returning to the destination.

1 32. The wellbore system of claim 30, wherein the controller performs at least one
2 operation in response to the data retrieval from the at least one flowable device.

1 33. A system for implanting at least one flowable device in the wall of the
2 wellbore during drilling of the wellbore, comprising:

- 3 - a drill string having a drill bit at end thereof for drilling the wellbore;
- 4 - a source of drilling fluid for supplying the drilling fluid to the drill string;
- 5 - a source for introducing at least one flowable device into the drilling
6 fluid; and
- 7 - an implanting device carried by the drill string uphole of the drill bit,
8 said implanting device receiving the at least one flowable device from
9 the drilling fluid and implanting the at least one flowable device in the
10 wall of the wellbore.

1 34. A method of utilizing flowable devices in a wellbore carrying a fluid from a
2 downhole location to the surface, each flowable device constituting a data carrier
3 and adapted to be moved by the fluid, said method comprising:

- 4 - locating a plurality of flowable devices at a selected location in a
5 wellbore; and
- 6 - selectively releasing the flowable devices into fluid, thereby moving
7 the flowable devices carry data from the selected location in the
8 wellbore to the surface.

9 35. The method of claim 34, wherein the locating of a plurality of the flowable
10 devices includes locating said devices in a magazine from where said devices are
11 individually releaseable into the flow of the fluid.

1 36. The method of claim 34 further comprising providing a controller in the
2 wellbore for inducing information n to the at flowable devices prior to their release
3 into the fluid.

1 37. The method of claim 34, wherein the releasing the flowable devices includes
2 at least one of (i) releasing the flowable devices at predetermined time intervals, (ii)
3 releasing a flowable device upon the occurrence of a particular event; or (iii)
4 releasing the flowable devices periodically.

1 38. A discrete flowable device adapted to be moved at least partially by a fluid
2 flowing in a wellbore, comprising:

- 3 - a sensor for taking measurements relating to a wellbore parameter;
- 4 - a controller for processing the sensor measurements;
- 5 - a memory for storing data;
- 6 - a power source for supplying power to elements of the flowable
- 7 device;
- 8 - an antenna for communicating information to a device external to the
- 9 flowable device; and

10 - a body housing the sensor, controller, memory and the power source,
11 which body is adapted to protect the device from wellbore conditions.

1 39. The discrete flowable device according to claim 38 further comprising an
2 external member that interacts with fluid in the wellbore to aid in generating
3 electrical energy.

1 40. The discrete flowable device according to claim 39, wherein the electrical
2 energy is utilized to charge the power supply.

1 41. The discrete flowable device according to claim 38 further comprising a
2 buoyancy device to alter the buoyancy of the discrete flowable device.

1 42. The discrete flowable device according to claim 38 further comprising a
2 propeller for aiding the discrete flowable device to flow in the wellbore.